CLAIMS

1. An optical switch comprising a mirror device (1, 1A) for reflecting light from an optical transmission path (11, 11a) on incident side and actuators (2) for actuating the mirror device,

the mirror device adapted for switching an optical path of the light incident from the optical transmission path on incident side into an optical transmission path (11, 11a, 11b) on outgoing side by the actuation performed by the actuator,

the actuators configured by piezoelectric elements (2) comprising piezoelectric thin films (3), electrodes (4a, 4b, 4c) for applying voltage for actuating the piezoelectric thin films, and elastic members (5) having the piezoelectric thin films and the electrodes, the optical switch, wherein longitudinal directions of the piezoelectric elements confronting across the mirror device are parallel and wherein the mirror device is actuated by flexure deformation of the piezoelectric thin films which is caused by application of voltage to the electrodes.

2. An optical switch as claimed in claim 1, wherein a mirror surface (1a) is provided on the mirror device in a plane that is parallel to the piezoelectric thin films and wherein the mirror device is inclined by the actuators relative to the plane that is parallel to the piezoelectric

thin films.

3. An optical switch as claimed in claim 2, wherein the actuators comprise a plurality of piezoelectric elements of which the longitudinal directions (8) are arranged in parallel, wherein the mirror device is held by torsion springs (6) that are arranged so as to be orthogonal to the longitudinal directions, and wherein the mirror is thus inclined in a rotation direction such that the torsion springs serve as a rotation axis.

4. An optical switch as claimed in claim 2, wherein the actuators comprise at least a plurality of piezoelectric elements of which both ends are supported as fixed ends and of which the longitudinal directions (8) are arranged in parallel and wherein strain absorbers (10) extending along the longitudinal directions are provided in part of the piezoelectric elements with respect to the longitudinal directions.

5. An optical switch as claimed in claim 1, wherein the actuators are composed of a plurality of piezoelectric elements, wherein each of the piezoelectric elements is partitioned into a plurality of electrodes, and wherein application of different voltages to the electrodes causes the piezoelectric thin films to undergo flexure deformation with different curvatures.

6. An optical switch as claimed in claim 1, wherein

the elastic members constituting the piezoelectric elements at least include silicon thin films or silicon oxide films that have constituted a Silicon-on-Insulator substrate.

7. An optical switch as claimed in claim 1, wherein mirror surfaces (1b) are provided on the mirror device so as to extend in a direction of a normal to the piezoelectric thin films and wherein the actuators actuate the mirror device in the direction of the normal to the piezoelectric thin films.

8. An optical switch as claimed in claim 7, wherein the actuators comprise at least a plurality of piezoelectric elements of which both ends are supported as fixed ends and of which the longitudinal directions (8) are arranged in parallel and wherein strain absorbers (49) extending along the longitudinal directions are configured in part of the piezoelectric elements with respect to the longitudinal directions.

9. An optical switch as claimed in claim 2 or 7, wherein the actuators comprise at least a plurality of piezoelectric elements of which both ends are supported as fixed ends and of which the longitudinal directions are arranged in parallel and wherein low-flexural-rigidity parts that flex with a reverse curvature with respect to a flexure curvature of the piezoelectric elements are configured.

10. An optical switch as claimed in claim 2 or 7, wherein the actuators comprise a mirror device holding device (14) for holding the mirror device in a specified position after translational movement of the mirror device.

11. An optical switch as claimed in claim 2 or 7, wherein the mirror device holding device is a device that holds the mirror device by electrostatic actuation independent of the actuation of the piezoelectric thin films or mechanically and wherein the application of the voltage to the piezoelectric thin films is canceled when the mirror device is held.

12. A method of manufacturing an optical switch comprising a mirror device (1, 1A) for reflecting light from an optical transmission path (11, 11a) on incident side and actuators (2) for actuating the mirror device, the mirror device adapted for switching an optical path of the light incident from the optical transmission path on incident side into an optical transmission path (11, 11a, 11b) on outgoing side by the actuation performed by the actuator,

the method comprising manufacturing a piezoelectric element of the actuators by transferring a piezoelectric thin film formed on a substrate onto another substrate.

13. A method of manufacturing an optical switch

comprising a mirror device (1, 1A) for reflecting light from an optical transmission path (11, 11a) on incident side and actuators (2) for actuating the mirror device, the mirror device adapted for switching an optical path of the light incident from the optical transmission path on incident side into an optical transmission path (11, 11a, 11b) on outgoing side by the actuation performed by the actuators,

the method comprising manufacturing a piezoelectric element of the actuators by directly producing a piezoelectric thin film on a substrate.

14. A method of manufacturing an optical switch as claimed in claim 13, wherein the substrate on which the piezoelectric thin film is produced is a Silicon-on-Insulator substrate.

15. An information transmission device using an optical switch comprising a mirror device (1, 1A) for reflecting light from an optical transmission path (11, 11a) on incident side and actuators (2) for actuating the mirror device, the mirror device adapted for switching an optical path of the light incident from the optical transmission path on incident side into an optical transmission path (11, 11a, 11b) on outgoing side by the actuation performed by the actuator,

the actuators configured by piezoelectric

elements (2) comprising piezoelectric thin films (3), electrodes (4a, 4b, 4c) for applying voltage for actuating the piezoelectric thin films, and elastic members (5) having the piezoelectric thin films and the electrodes, wherein longitudinal directions of the piezoelectric elements confronting across the mirror device are parallel, and wherein the mirror device is actuated by flexure deformation of the piezoelectric thin films which is caused by application of voltage to the electrodes.

16. An information transmission device as claimed in claim 15, wherein a mirror surface (1a) is provided on the mirror device in a plane that is parallel to the piezoelectric thin films, wherein the mirror device is inclined by the actuators relative to the plane parallel to the piezoelectric thin films, and wherein a plurality of the optical transmission paths arranged in a plane generally normal to the thin films are thus switched by control of an angle of reflection of the mirror surface.

17. An information transmission device as claimed in claim 15, wherein mirror surfaces (1b) are provided on the mirror device so as to extend in a direction of a normal to the piezoelectric thin films and wherein by actuating by the actuators the mirror device in the direction of the normal to the piezoelectric thin films, the mirror device is inserted into a plurality of the optical transmission

paths arranged in a plane in parallel with the thin films, and switch the transmission paths.

18. An information transmission device as claimed in claim 16 or 17, wherein the actuators comprise a plurality of rows of piezoelectric elements having longitudinal directions arranged in parallel and wherein the plurality of optical transmission paths are arranged in correspondence to the plurality of rows of piezoelectric elements.